

THE average heat-value of well-purified coal-gas at constant volume has been recently determined by M. Witz (*Ann. de Chim. et de Phys.*) as about 5200 calories per cubic metre at 0° and 760 mm. when the water formed is fully condensed. This value, got from a great variety of experiments with gas from different works, appears to make the generally-accepted figure of 6000 calories about 15 per cent. too high, and the calculation of gas motors is here concerned. The heat-value of the gas from one and the same works varied in the course of a year from 4719 to 5425 calories, which was more than the variation between different works. The influence of temperature and external pressure was not perceptible. The operations for purifying gas diminish the heat-effect, sometimes as much as 5 per cent. The gas of the last hour of distillation is (contrary to the usual view) less rich than that of the first hour. Dilution with oxygen lessens the heat-value; but in dilution with air, curiously, no such effect was observed; the heat of combustion was the same with six or with ten volumes of air.

IN his investigations of the changes of level of inland lakes (known as *seiches*), Prof. Forel has arrived at the simple formula $t = l / \sqrt{gh}$ for those movements, in which t expresses the time, in seconds, of a half oscillation of a uninodal *seiche*, l , the length, and h , the mean depth of the cross-section of the lake in which the variation is observed. This formula holds good for the lakes of Neuchâtel, Brienz, Thun, Wallenstadt, and Geneva. An interesting confirmation of it is found by M. Forel in observations made by Mr. Russel with a limnograph on Lake George in New South Wales. This instrument had recorded 33 very regular *seiches* on the lake this year, and the duration of a whole oscillation proved to be 131 minutes. Now the length of the lake being 28,962 metres, the above formula gives, for the mean depth, 5'536 metres, or 18'1 feet. Mr. Russel states that the mean depth is between 15 and 20 feet.

THE prevailing direction of the winds on the shores of the Black Sea and the Sea of Azov has been recently studied in great detail, and in connection with the recent progress of meteorology with regard to wind generally, by M. Spindler, who has published his work, with maps, in the Russian *Maritime Review* (*Morskoy Sbornik*). Four maps show the prevailing direction of the wind at 7 a.m. and at 1 p.m. during the four seasons of the year. During the winter a notable difference between the prevailing direction at these two hours of the day is seen only on the eastern shore; while in the spring and summer nearly everywhere on the Russian coast of the Black Sea these two directions differ by 90°, and at some places they are quite opposite to one another, thus showing that the predominating influence of the currents of air depend upon the different heating of land and sea.

IT is reported from Kara-hissar, in Asia Minor, that an earthquake shook that neighbourhood on Tuesday, December 2. In the hamlet of Kemin the earth opened for a length of about 40 feet, and from 3 to 5 feet wide.

THE last earthquake shock in Algeria was felt at Blidah on December 13, at 5 a.m. Subterranean noises were heard. The first shock, in Hussein Dey, near Algiers, was felt on December 3, at 8h. 23m. a.m. This has been proved by the stopping of a clock in a distillery.

How great are still the numbers of Carnivora in Finland may be seen from the following figures, given in the last issue of the "Statistical Yearbook" for Finland. In 1882 not less than 85 bears, 128 wolves, 407 lynxes, 4005 foxes, 76 gluttons, 240 river otters, 148 martens, 1583 ermines, and 3947 carnivorous birds were killed, for which an aggregate of 1646*l.* was paid in premiums by the Government. The ravages occasioned by Car-

nivora the same year were immense: they are estimated at 274 horses, 846 horned cattle, 5246 sheep, 168 pigs, 119 goats, 1681 reindeer, and 2366 domestic fowls. The greatest number of bears were killed in Viborg and Uleåborg (respectively 33 and 30), while most wolves were killed in the more densely-peopled Government of Tavastehuus.

AT the meeting of the Royal Physical Society of Edinburgh, held December 16, the following office-bearers were elected, viz.—President: Prof. William Turner, F.R.S.S.L. and E., Edinburgh University; Vice-Presidents: John A. Harvie-Brown, F.R.S.E., Rev. John Duns, D.D., Prof. J. Cossar Ewart, F.R.S.E.; Secretary: Robert Gray, V.P.R.S.E.; Assistant-Secretary: John Gibson; Treasurer: Charles Prentice, F.R.S.E.; Librarian: William Evans Hoyle, F.R.S.E.; Council: John Hunter, F.C.S., Robert Kidston, F.G.S., A. B. Herbert, Prof. James Geikie, F.R.S., G. Sims Woodhead, F.R.C.P.Ed., Hugh Miller, F.G.S., Arthur W. Hare, M.B., R. Milne-Murray, M.R.C.P.E., H. Moubray Cadell, B.Sc., R. H. Traquair, F.R.S., R. Sydney Marsden, D.Sc., F.R.S.E., Benjamin N. Peach, F.G.S., F.R.S.E.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by the Rev. Spencer Fellows; a Black-backed Jackal (*Canis mesomelas*) from South Africa, presented by Mr. J. Robson; a Slender-billed Cockatoo (*Nymphicus tenuirostris*) from Australia, presented by Mrs. Sturt Cavell; a Kestrel (*Tinnunculus alaudarius*), British, presented by Mr. T. E. Gunn; three Wild Ducks (*Anas boschas*), British, presented by Mr. C. T. McNiven; a Lapwing (*Vanellus vulgaris*), British, purchased.

OUR ASTRONOMICAL COLUMN

TOTAL SOLAR ECLIPSE, 1886 AUGUST 28-29.—The eclipse will be total throughout the Island of Grenada. The Greenwich mean times of beginning and ending of totality for any point in the island may be found from the formulæ:—

$$\begin{aligned} \cos w = & -4.99267 - [1.77822] \sin l + [1.26284] \cos l \cos (\lambda + 48^\circ 13' 5'' \\ t = 1h. 12m. 41.7s. & \mp [2.04698] \sin w - [3.24330] \sin l \\ & - [3.4970] \cos l \cos (\lambda + 82^\circ 53' 0''), \end{aligned}$$

where l is the geocentric latitude of the place, λ its longitude from Greenwich, taken negatively, and the quantities in square brackets are logarithms; upper sign for beginning, lower for ending.

For long. 4h. 6m. 20s. W., lat. $11^\circ 59' 5''$ N. near the southern extremity of the island, totality begins at 19h. 11m. 0s. local mean time, and continues 3m. 42s. \odot 's altitude 20° .

In long. 4h. 6m. 40s. W., lat. $12^\circ 15' 0''$ N. near the northern extremity of the island, totality begins at 19h. 10m. 37s. local mean time, and continues 3m. 37s.

At Carriacou I. (Grenadines)—

Totality commences at 19h. 11m. 45s. local M.T.

Duration 3m. 21s.

Sun's altitude 20°

FABRY'S COMET.—Dr. H. Oppenheim continues his ephemeris of this comet in the *Dun Echt Circular*, No. 102, as follows:—

Ephemeris for Berlin Midnight									
1885	App. R.A.			App. Decl.			Log. Δ Brightness		
	h.	m.	s.	h.	m.	s.			
Dec. 28	23	48	29	...	+20	52.6	...	0.0849	1.6
29	...	47	14	...	...	54.8	...	...	...
30	...	46	2	...	...	57.3	...	...	...
31	...	44	52	...	21	0.0	...	...	...
32	...	43	45	...	3.0	...	0.0850	...	1.8

β CYGNI OR 6 CYGNI?—M. Flammarion in the December number of *L'Astronomie* falls into a curious confusion with regard to these stars. Dr. Ball had found the parallax of B.A.C. 6579 (B) to be $+0''.482 \pm 0''.054$, and following Bode's numbers called the star β (B) Cygni. Unfortunately, however, M. Flammarion supposed Dr. Ball referred to Flamsteed's δ Cygni, which is β Cygni, and based an article on the supposed determination

of its parallax. The mistake was a very easy one to make, but at least the Dunsink observations are not to blame, for Dr. Ball gives not only the place of the star he observed but its number in three catalogues—Groombridge, Struve's *Mensura*, and the *Durchmusterung*.

BARNARD'S COMET.—Dr. H. Oppenheim (*Astr. Nachr.*, No. 2697) has computed the following elements and ephemeris for this comet:—

Perihelion Passage = 1886 May 14^h 14^m 30^s Berlin M. T.

$$\left. \begin{array}{l} \omega = 116^\circ 31' 57'' \\ \Omega = 66^\circ 22' 12'' \\ i = 94^\circ 8' 7'' \end{array} \right\} \text{Mean Eq. 1885}^\circ 0$$

log. $q = 9.74184$

Error of the middle observation:—

$$\delta \lambda = +4'' \quad \delta \beta = -3''$$

The elements resemble those of Comet 1785 II.

Ephemeris for Berlin Midnight

1885	App. R.A.	App. Decl.	Log. Δ	Brightness
	h. m. s.			
Dec. 24 ...	3 30 5	+7° 2' 6"	0.2372	1.3
26 ...	25 12	19.8		
28 ...	20 23	37.5	0.2358	1.4
30 ...	15 39	55.8		
32 ...	11 1	+8 14.6	0.2359	1.5

The brightness on December 5 is taken as unity.

THE PULKOWA OBSERVATORY.—From his Report, presented May 25, 1885, it appears that M. O. Struve was chiefly occupied, during the year to which the Report refers, with work connected with the erection of the great 30-inch refractor. Various unexpected delays had occurred, in connection chiefly with the construction of the dome, but, at the time of writing his Report, M. Struve states that regular observations could be commenced immediately. He expresses himself as greatly pleased with the mounting of the instrument, which has been designed and constructed by the Repsolds. At present the dome is moved by hand, but it is hoped that this may eventually be done by electricity, and that motive power will thus be obtained sufficient to overcome the hindrance to the rotation of the dome caused by snow and frost. It is proposed to use the great refractor for observing such double-stars as are beyond the reach of the 15-inch equatorial, and to undertake observations of interesting nebulae, as well as spectroscopic researches in cases where the great optical power of the instrument will be of special importance. We learn from *Science* that M. Struve has written to Messrs. Alvan Clark and Sons, acknowledging the excellent performance of the object-glass furnished by them, and announcing that the Emperor of Russia had conferred on them the Honorary Gold Medal of the Empire.

Notwithstanding the additional cares and labours thus imposed on the staff of the Pulkowa Observatory, further increased by M. O. Struve's regrettable illness, the usual work in the various departments has been kept up with vigour, and it is evident that the famous Russian institution, under its present superintendent, will continue to maintain its great reputation.

SUSPECTED "NEW" STAR.—It is announced in the *Dun Echt Circular*, No. 104, that Mr. Gore, observing with a binocular on the evening of December 13, found a reddish star of 6th mag., and about 20' following χ Orionis. This object is not given by Harding, Lalande, Heis, Birmingham, or the Bonn maps. On December 16 Copeland and Becker, observing at Dun Echt, found it of the 6th mag., and of an orange-red colour. It has a very beautiful banded spectrum of the third type, seven dark bands being readily distinguished with the prism. The bright intervals seem full of bright lines, especially in the green and blue. The mean place for 1885 is R.A. 5h. 48m. 59s.; Decl. +20° 9' 4".

ASTRONOMICAL PHENOMENA FOR THE WEEK 1885 DECEMBER 27—1886 JANUARY 2

(For the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on December 27

Sun rises, 8h. 8m.; souths, 12h. 1m. 27.7s.; sets, 15h. 55m.; decl. on meridian, 23° 19' S.; Sidereal Time at Sunset, 22h. 20m.

Moon (at Last Quarter on Dec. 28) rises, 22h. 18m.*; souths, 4h. 56m.; sets, 11h. 23m.; decl. on meridian, 4° 19' N.

Planet	Rises	Souths	Sets	Decl. on meridia
	h. m.	h. m.	h. m.	
Mercury ...	6 36	10 51	15 6	19° 57' S.
Venus ...	10 28	15 13	19 58	15° 5' S.
Mars ...	22 30*	5 6	11 42	6° 19' N.
Jupiter ...	23 57*	5 57	11 57	0° 50' S.
Saturn ...	15 44	23 54	8 4*	22° 31' N.

* Indicates that the rising is that of the preceding and the setting that of the following day.

Occultations of Stars by the Moon

Dec.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	
27 ...	τ Leonis ...	5	5 48	6 47	110° 232'
29 ...	θ Virginis ...	4½	4 5	5 15	60° 211'
Jan.					
1 ...	η Libræ ...	6	5 8	6 15	58° 210'
Dec.	h.				
27 ...	9				Mars in conjunction with and 2° 48' north of the Moon.
28 ...	9				Jupiter in conjunction with and 0° 5' south of the Moon.
31 ...	5				Sun at least distance from the Earth.

Variable Stars

Star	R.A.	Decl.	h. m.
	h. m.		
U Cephei ...	0 52.2	81° 16' N.	Dec. 29, 1 24 m
Algol ...	3 0.8	40° 31' N.	" 27, 21 29 m
ζ Geminorum ...	6 57.4	20° 44' N.	Jan. 2, 22 M
S Canis Minoris ...	7 26.5	8° 34' N.	Dec. 27, M
S Cancræ ...	8 37.4	19° 27' N.	" 31, 4 8 m
δ Libræ ...	14 54.9	8° 4' S.	" 29, 18 39 m
			Jan. 1, 2 30 m
U Coronæ ...	15 13.6	32° 4' N.	Dec. 30, 5 59 m
R Coronæ ...	15 43.9	28° 30' N.	" 31, M
δ Cephei ...	22 24.9	57° 50' N.	Jan. 1, 6 m
			" 2, 22 M

M signifies maximum; m minimum.

Meteor Showers

The principal periodic shower at this time is that of the *Quadrantids*, R.A. 225°–232°, Decl. 55°–60° N., seen on January 2 and 3. As the radiant-point rises after midnight, the shower must be looked for during the morning hours. A shower with radiant near Aldebaran may be looked for during this week and throughout January.

Stars with Remarkable Spectra

Mira Ceti, R.A. 2h. 13m. 36s., Decl. 3° 29' 6" S., should be examined with the spectroscope on every favourable opportunity now that it is approaching its maximum. It is a fine example of Secchi's third type.

Star	R.A. 1886°	Decl. 1886°	Mag.	Type of spectrum
	h. m. s.			
γ Cassiopeiæ ...	0 50 6	60° 7' N.	2.2	Bright lines
Mira Ceti ...	2 13 36	3° 29' S.	Var.	III.
ρ Arietis ...	2 49 24	17° 52' N.	6.0	III.
α Ceti ...	2 51 19	3° 38' S.	2.5	III.
ρ Persei ...	2 57 52	38° 24' N.	Var.	III.
D.M. + 57° 702 ...	3 2 38	57° 28' N.	7.9	IV.
51 Schj. ...	4 59 30	1° 12' N.	6.0	IV.
20 Leporis ...	5 6 3	11° 59' S.	6.0	III.
α Orionis ...	5 49 0	7° 23' N.	Var.	III.
μ Geminorum ...	6 16 3	22° 33' N.	3.0	III.
78 Schj. ...	6 28 42	38° 31' N.	6.3	IV.
51 Geminorum ...	7 6 49	16° 18' N.	5.5	III.

GEOGRAPHICAL NOTES

Two papers in the December number of the *Proceedings* of the Royal Geographical Society are of unusual interest. The first is Mr. F. Simons's account of his exploration of the Goajira peninsula of the United States of Colombia; the second, a series of letters, hitherto unpublished in English, from Colonel Prjevalsky, translated by Mr. Delmar Morgan. Mr.